Listing of Claims

The following listing of claims replaces all prior versions and listings of claims in the application.

1. (Previously presented): A confocal microscope using liquid crystal, comprising:

an inlet optical part to let a polarized light from a polarized light from an illuminating light source and a straight polarizer onto an object to be observed via a beam splitter, a matrix type liquid crystal device provided with a microlens array on its top part, and an objective lens;

a light detecting part including an imaging device to detect a reflected or a fluorescent light from the object to be observed via said beam splitter and lens; and

a control part including a liquid crystal control subpart to control each pixel of said matrix type liquid crystal device,

characterized in that it transmits the light passing through said microlens array from each microlens to each pixel of said matrix type liquid crystal device aligned in the position corresponding to said each microlens, and makes a plurality of foci on said object to be observed by said objective lens, as well as controls the polarization direction of the light transmitted through each neighboring pixel of said matrix type liquid crystal device using said liquid crystal control subpart, and

said liquid crystal control subpart controls polarization directions of the lights transmitted through each neighboring pixel of the matrix type liquid crystal device so that they are made mutually orthogonal, and makes a plurality of foci with the lights the polarization directions of which are mutually orthogonal onto an object to be observed.

2. (Original): The confocal microscope using liquid crystal as set forth in claim 1, characterized in that a polarizer is located in the lower part of said matrix type liquid crystal device and a polarized light transmitted through said polarizer is controlled by each pixel of said matrix type liquid crystal.

3. (Previously presented): A confocal microscope using liquid crystal, comprising:

a inlet optical part to let a polarized light from an illuminating light source and a straight polarizer onto an object to be observed via a beam splitter, a lens, and the first matrix type liquid crystal device provided with a first microlens array on its top part,

a light detecting part including an imaging device to detect a reflected or a fluorescent light from an object to be observed via a beam splitter, a lens, and a second matrix type liquid crystal device provided with a second microlens array on its top part; and

a control part including a first and a second liquid crystal control subpart to control a polarization direction of a light transmitted through each pixel of said first and second matrix type liquid crystal device,

characterized in that it transmits the light passing through said first microlens array from each microlens to each pixel of said first matrix type liquid crystal device aligned in the position corresponding to said each microlens, and makes a plurality of foci on said object to be observed,

and further, it transmits said reflected or fluorescent light passing through said second microlens array from each microlens array to each pixel of said second matrix type liquid crystal device aligned in the position corresponding to each microlens, and makes a plurality of foci on said imaging device, as well as controls the polarization direction of the light transmitted through each pixel of the first matrix type liquid crystal device using the first liquid crystal control subpart, and said first liquid crystal control subpart controls polarization directions of the lights transmitted through each neighboring pixel of said first matrix type liquid crystal device to be mutually orthogonal, thereby making a plurality of foci with the lights the polarization directions of which are mutually orthogonal onto an object to be observed, and controls the polarization direction of the light transmitted through each pixel of said second matrix type liquid crystal device using the second liquid crystal control subpart, and said second liquid crystal control subpart controls polarization directions of the lights transmitted through each neighboring pixel of said second matrix type liquid crystal device to be mutually orthogonal, thereby making a plurality of foci with the lights the polarization directions of which are mutually orthogonal onto an imaging device.

4. (Canceled)

5. (Canceled)

6. (Original): The confocal microscope using liquid crystal as set forth in claim 3, characterized in that, a polarizer is located in the lower part of said first matrix type liquid crystal device, and a polarization direction of the light transmitted through said polarizer is controlled by each pixel of said first matrix type liquid crystal.

7. (Original): A confocal microscope using liquid crystal, comprising:

an inlet optical part to let an amplitude modulated polarized light from an illuminating light source onto an object to be observed via a beam splitter, a matrix type liquid crystal device provided with a microlens array on its top part, and an objective lens;

a light detecting part including an imaging device to detect a reflected or a fluorescent light from the object to be observed via said beam splitter and a lens; and

a control part including a liquid crystal control subpart to control each pixel of said matrix type liquid crystal device, and an amplitude modulation control part of said illuminating light source,

characterized in that it transmits the light passing through said microlens array from each microlens to each pixel of said matrix type liquid crystal device, and makes a plurality of foci said object to be observed by said objective lens, as well as it controls the polarization directions of the lights transmitted through each pixel of said matrix type liquid crystal device so that they are made mutually orthogonal by using said liquid crystal control subpart, and detects amplitude modulation signals of the reflected or fluorescent light from said object to be observed by transforming them to frequency component signals.

8. (Original): The confocal microscope using liquid crystal as set forth in claim 7, characterized in that a polarizer is located in the lower part of said matrix type liquid crystal device, and an polarized light transmitted through said polarizer is controlled by each pixel of said matrix type liquid crystal.

9. (Original): The confocal microscope using liquid crystal as set forth in claim 7, characterized in that said illuminating light source is of either single wavelength or multi

wavelengths, and said illuminating light source is amplitude modulated by using either a matrix type liquid crystal device, an acoustooptic modulator, or a digital mirror device.

10. (Original): The confocal microscope using liquid crystal as set forth in claim 7 or 9, characterized in that, the amplitude modulation for each wavelength of said illuminating light source is applied to each pixel by a plurality of modulation frequency.

11. (Original): The confocal microscope using liquid crystal as set forth in claim 7, characterized in that, the conversion of amplitude modulation signals of the reflected or fluorescent light from said object to be observed to frequency signals is operation-processed by high speed Fourier transform.

12. (Original): A confocal microscope using liquid crystal, comprising:

a inlet optical part to let an amplitude modulated polarized light from an illuminating light source onto an object to be observed via a beam splitter, a lens, and a first matrix type liquid crystal device provided with a first microlens array on its top part,

a light detecting part including an imaging device to detect a reflected or a fluorescent light from the object to be observed via a beam splitter, a lens, a second matrix type liquid crystal device provided with a second microlens array on its top part, and a condenser lens; and

a control part including a first and a second liquid crystal control subpart to control a polarization direction of a light transmitted through each pixel of said first and second matrix type liquid crystal device,

characterized in that it transmits the light passing through said first microlens array from each microlens to each pixel of said first matrix type liquid crystal device, and makes a plurality of foci on said object to be observed,

and further, it transmits said reflected or fluorescent light passing through said second microlens array from each microlens array to each pixel of said second matrix type liquid crystal device, and makes a plurality of foci on said imaging device, as well as controls the polarization direction of the light transmitted through each pixel of said first and second matrix type liquid crystal devices using said first and second liquid crystal control subpart, and detects amplitude

modulation signals of the reflected or fluorescent light from said object to be observed by converting them to frequency signals.

13. (Original): The confocal microscope using liquid crystal as set forth in claim 12, characterized in that, said first liquid crystal control subpart of said inlet optical part controls polarization directions of the lights transmitted through each pixel of said first matrix type liquid crystal device so that they are made mutually orthogonal.

14. (Original): The confocal microscope using liquid crystal as set forth in claim 12, characterized in that, said second liquid crystal control subpart of said light detecting part controls polarization directions of the lights transmitted through each pixel of said second matrix type liquid crystal device so that they are made mutually orthogonal.

15. (Original): The confocal microscope using liquid crystal as set forth in claim 12, characterized in that, a polarizer is located in the lower part of said first matrix type liquid crystal device, and the polarized light transmitted through said polarizer is controlled by each pixel of said matrix type liquid crystal.

16. (Original): The confocal microscope using liquid crystal as set forth in claim 12, characterized in that, said illuminating light source is of either single wavelength or multi wavelengths, and said illuminating light source is amplitude modulated by using either a matrix type liquid crystal device, an acoustooptic modulator, or a digital mirror device.

17. (Original): The confocal microscope using liquid crystal as set forth in claim 12 or 16, characterized in that, the amplitude modulation for one wavelength of said illuminating light source is applied to each pixel by a plurality of modulation frequency.

18. (Original): The confocal microscope using liquid crystal as set forth in claim 12, characterized in that the transform from the amplitude modulation signal of the reflected or fluorescent light of said object to be observed to frequency signal is processed by Fast Fourier Transform.

19. (Currently amended): The method of measuring fluorescence of a microarray substrate by a confocal microscope using liquid crystal, characterized in that for the fluorescence measurement of a microarray substrate with a fluorescent material as a selective marker given in advance, the fluorescence from said fluorescent material is observed by using a confocal microscope using liquid crystal as set forth in ~~any one of claims 7 to 18~~ claim 7 or 12.

20. (Original): The method of measuring fluorescence from a microarray substrate by a confocal microscope using liquid crystal as set forth in claim 19, characterized in that said microarray substrate contains a minute amount of DNA or a biological material.

21. (Currently amended): The method of measuring fluorescence from a microarray substrate by a confocal microscope using liquid crystal as set forth in claim 19 [[or 20]], characterized in that, said microarray substrate is a DNA chip.

22. (Currently amended): The method of measuring polarized light by said confocal microscope, characterized in that for measuring polarized light from the reflected or fluorescent light from an object to be observed, the polarized light from said object to be observed is measured by using a confocal microscope using liquid crystal as set forth in ~~any one of claims 7 to 18~~ claim 7 or 12.

23. (Original): The method of measuring polarized light by the confocal microscope using liquid crystal as set forth in claim 22, characterized in that in the liquid crystal matrix of said confocal microscope using liquid crystal, the polarized light from said object to be observed is measured by rotating said polarized light by 180 degrees.

24. (New) The method of measuring fluorescence of a microarray substrate by a confocal microscope using liquid crystal, characterized in that for the fluorescence measurement of a microarray substrate with a fluorescent material as a selective marker given in advance, the fluorescence from said fluorescent material is observed by using a confocal microscope using liquid crystal as set forth in any one of claims 1, 2, 3, and 6.

25. (New) The method of measuring fluorescence of a microarray substrate by a confocal microscope using liquid crystal as set forth in claim 24, characterized in that said microarray substrate contains a minute amount of DNA or a biological material.

26. (New): The method of measuring fluorescence of a microarray substrate by a confocal microscope using liquid crystal as set forth in claim 24, characterized in that said microarray substrate is a DNA chip.

27. (New) The method of measuring polarized light by said confocal microscope, characterized in that for measuring polarized light from the reflected or fluorescent light from an object to be observed, the polarized light from said object to be observed is measured by using a confocal microscope using liquid crystal as set forth in any one of claims 1, 2, 3, and 6.

28. (New) The method of measuring polarized light by a confocal microscope using liquid crystal as set forth in claim 27, characterized in that in the liquid crystal matrix of said confocal microscope using liquid crystal, the polarized light from said object to be observed is measured by rotating said polarized light by 180 degrees.